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STARGAZER FISHES FROM THE WESTERN NORTH ATLANTIC (FAMILY URANOSCOPIDAE)

By FREDERICK H. BERRY *and* WILLIAM W. ANDERSON

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STARGAZER FISHES FROM THE WESTERN NORTH ATLANTIC (FAMILY URANOSCOPIDAE)

By Frederick H. Berry and William W. Anderson[1]

This review of the fishes of the family Uranoscopidae from the western North Atlantic is a consequence of our efforts to identify large series of various sizes of these fishes that have been taken in recent years by exploratory fishing in this area. It is based on all the uranoscopid specimens from this area in the collections of the U.S. National Museum, selected specimens from other institutions, and specimens at the U.S. Fish and Wildlife Service's Biological Laboratory at Brunswick, Georgia. Many of the specimens at Brunswick will subsequently be transferred to the U.S. National Museum.

Five species of stargazers have been recognized in our study of the family in the western North Atlantic. Illustrations, diagnostic characters, and known ranges are presented for these species. *Astroscopus y-graecum* Cuvier and *Astroscopus guttatus* Abbott are distinguished. *Execestides* Jordan and Thompson is synonymized with *Gnathagnus* Gill, and *E. egregius* Jordan and Thompson is included in

[1] United States Fish and Wildlife Service. This paper is Contribution No. 51 of the U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries Biological Laboratory, Brunswick, Georgia.

the genus *Gnathagnus*. *Gnathagnus laticeps* (Longley and Hildebrand) is synonymized with *Gnathagnus egregius*. *Kathetostoma albigutta cubana* Barbour is distinguished as a species distinct from *Kathetostoma albigutta* Bean. *Uranoscopus occidentalis* Agassiz, described from Brazil, is included on the basis of the type description.

Astroscopus sexspinosus (Steindachner) was described from Argentina and Rio de Janeiro, Brazil, in the western South Atlantic (Steindachner, 1876) as *Uranoscopus* (*Upsulonophorus*) *sexspinosus*. It reportedly differs from *A. y-graecum* and *A. guttatus* in having a blackened border on the soft dorsal fin (Miranda Ribeiro, 1915), but specimens adequate for assessing its true relationship have not been available.

Data on dorsal and anal rays and data on pectoral rays are given in table 1, p. 566. A chart of distribution of *Kathetostoma albigutta*, *K. cubana*, and *Gnathagnus egregius* is shown in figure 1, next page.

Standard length (S.L.) was measured from the middle of the upper jaw (premaxillary symphysis) to the caudal base. Total length (T.L.) was measured from the most anterior part of the lower jaw to end of the caudal fin.

Dorsal and anal fin ray counts were made by counting the total number of rays (or ray bases), except in a minority of specimens that had the terminal soft ray in very close proximity to the next to the last soft ray. Dissection and clearing and staining showed that in certain specimens the terminal dorsal or anal soft ray was branched to its base and the two terminal elements were articulated beneath the body surface; it was therefore considered a branched ray and was counted as a single ray.

Pectoral and pelvic rays were counted on each side of the fish, and are recorded without respect to right or left sides. Bilateral variation may occur in the number of pectoral fin rays, but the side of a fish having the greater number is randomly right or left.

Terminology of the cranial bones follows Gregory (1933, figs. 244–248).

In the synonymies, a comma is used between the binomial and the author's name only in instances of emended or altered specific combinations; no comma is used in instances of original combinations.

The specimens examined are listed for each species by geographical location from north to south along the Atlantic coast of the United States to southern Florida, then northward, westward, and southward around the Gulf of Mexico into the Caribbean Sea. The following abbreviations are used: USNM, U.S. National Museum; CNHM, Chicago Natural History Museum; CM, Charleston Museum; CAS, California Academy of Sciences; UMML, University of Miami Marine

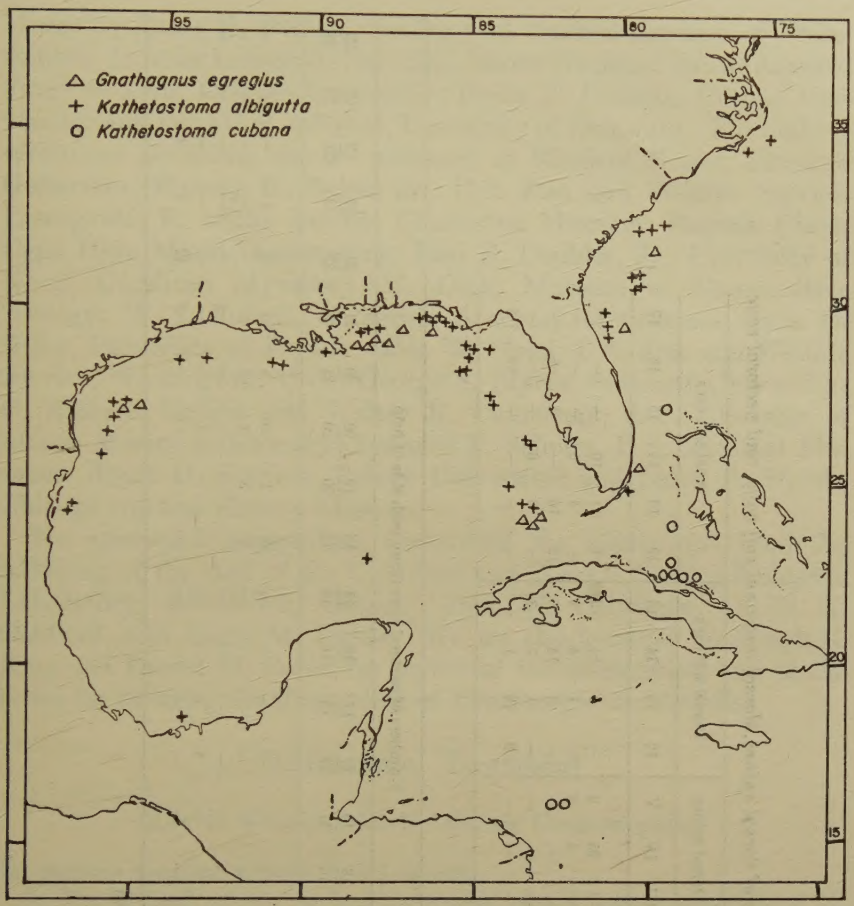


FIGURE 1.—Distribution of *Kathetostoma albigutta, Kathetostoma cubana,* and *Gnathagnus egregius,* including specimens examined and specimens reported by Springer and Bullis (1956, p. 97) and Hildebrand (1954, p. 318). A single specimen of *K. cubana* from east of Puerto Rico is not shown on this chart.

Laboratory; UF, University of Florida; TU, Tulane University; SU, Stanford University; MCZ Museum of Comparative Zoology; UNC, University of North Carolina; CHML, Cape Haze Marine Laboratory; GWM acct. No., G. W. Mead, U.S. Fish and Wildlife Service, Washington, D.C.; BLBG, U.S. Fish and Wildlife Service Biological Laboratory, Brunswick, Ga.

We owe special thanks for assistance in obtaining data on specimens to Leonard P. Schultz and Robert Kanazawa, U.S. National Museum; Myvanwy M. Dick, Museum of Comparative Zoology; G. Palmer, British Museum (Natural History); George S. Myers, Margaret Storey, and Stanley Weitzmann, Stanford University Natural History

TABLE 1.—*Frequencies of dorsal spines, dorsal and anal soft rays, and pectoral rays*

Species	Dorsal spines			Dorsal soft rays				Anal soft rays					
	III	IV	V	12	13	14	15	12	13	14	15	16	17
Astroscopus y-graecum	1	25	2	—	1	14	13	1	11	16	—	—	—
Astroscopus guttatus	—	4	6	—	1	4	4	—	4	5	—	—	—
Kathetostoma albigutta	—	—	—	—	4	14	5	12	10	—	1	—	—
Kathetostoma cubana	—	—	—	—	1	7	3	—	5	6	—	—	—
Gnathagnus egregius	—	—	—	2	19	1	—	—	—	—	—	18	4

Species	Numbers of pectoral rays (from each side of fish)																				
	13/14	14/14	14/15	15/15	15/16	16/16	16/17	17/17	17/18	18/18	18/19	19/19	19/20	20/20	20/21	21/21	21/22	22/22	22/23	23/23	23/24
Astroscopus y-graecum [a]	—	—	—	—	—	—	—	—	—	—	—	2	1	10	5	6	2	1	—	—	—
Astroscopus guttatus	—	—	—	—	—	—	—	—	—	—	—	1	2	3	2	1	—	—	—	—	—
Kathetostoma albigutta	1	—	3	15	2	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kathetostoma cubana	—	—	—	—	—	—	—	4	3	4	—	—	—	—	—	—	—	—	—	—	—
Gnathagnus egregius [b]	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	5	12	7	3	1	1

[a] One specimen with a stunted pectoral fin and counts of 14/20.

[b] One specimen with counts of 20/22.

Museum; James E. Böhlke, Academy of Natural Sciences of Philadelphia; Antenor Leiatão de Carvalho, Museo Nacional, Rio de Janeiro; Frank S. Cliff, Colgate University; Bruce B. Collette, Cornell University; and Donald P. deSylva, University of Delaware. For making specimens available, we are indebted to Winfield Brady, Florida's Gulfarium; Harvey R. Bullis, Jr., U.S. Fish and Wildlife Service, Pascagoula; E. Milby Burton, Charleston Museum; Eugenie Clark, Cape Haze Marine Laboratory; Earl E. Deubler, Jr., University of North Carolina; Myvanwy M. Dick, Museum of Comparative Zoology; W. I. Follett, California Academy of Sciences; John D. Kilby, University of Florida; Giles W. Mead, U.S. Fish and Wildlife Service, Washington, D.C.; George S. Myers, Stanford University; C. Richard Robins and Walter R. Courtenay, Jr., University of Miami Marine Laboratory; Leonard P. Schultz, U.S. National Museum; Royal D. Suttkus, Tulane University; and Loren P. Woods, Chicago Natural History Museum.

We appreciate suggestions concerning the manuscript from the following of the staff of the U.S. Fish and Wildlife Service Biological Laboratory, Brunswick, Georgia: Jack W. Gehringer, David K. Caldwell, and Hugh M. Fields. We are also indebted to Joseph E. King and Daniel M. Cohen for review of the manuscript, and to the latter for securing the illustration of *Uranoscopus occidentalis*.

Taxonomic Treatment

Key to Western North Atlantic Uranoscopidae

1*a*. Spinous dorsal fin present (3 to 5 spines).

2*a*. Top of head entirely covered by exposed cranial bones (apparently in all sizes); cleithral spines long, sharp pointed, and protruding through the skin. (*Uranoscopus* Linnaeus 1758; one species reported from Brazil.)

Uranoscopus occidentalis Agassiz

2*b*. Top of head partially covered by skin (plate 1) (in sizes over 34 mm. S.L. or 40 mm. T.L.); cleithral spines short, adpressed to body, bluntly pointed and covered with skin. (*Astroscopus* Brevoort 1860.)

3*a*. Posterior end of rear nostril groove much closer to eye (orbit) than to posterior margin of skin-covered area over electric organs; distance from eye to end of rear nostril groove (a in plate 1G) about 1.9 to 11.0 times into distance from end of rear nostril groove to posterior margin of skin-covered area (b in plate 1G), in sizes above 40 mm. S.L. Y-shaped process on head usually long and narrow (plate 1), least width of its base about 1.4 to 2.4 percent of standard length at sizes larger than 100 mm. S.L. Top of head and body with large, widely spaced white spots (plate 2B). (North Carolina to Brazil.)

Astroscopus y-graecum (Cuvier)

3*b*. Posterior end of rear nostril groove usually closer to posterior margin of skin-covered area over electric organs than to eye (orbit) or not much closer to eye; distance from eye to end of rear nostril groove (a in plate 1G)

about 0.5 to 1.6 times into distance from end of rear nostril groove to posterior margin of skin-covered area (b in plate 1G), in sizes above 40 mm. S.L. Y-shaped process on head usually short and broad (plate 1), least width of its base about 2.5 to 3.8 percent of standard length in sizes larger than 100 mm. S.L. Top of head and body with small, closely spaced, white spots (plate 2C). (North Carolina to New York.)

Astroscopus guttatus Abbott

1*b*. Spinous dorsal fin absent.

4*a*. Lower jaw with a pair of prominent converging bony ridges on anterior part, deeply notched between (plate 4D). Preopercle with lower edge developed as a long flattened wing-like appendage, without true spines. Body with embedded scales (readily apparent at 100 mm. S.L. and larger). Cleithral spine flattened and bluntly pointed. (*Gnathagnus* Gill 1861; one species in western North Atlantic, Georgia to Texas.)

Gnathagnus egregius (Jordan and Thompson)

4*b*. Lower jaw without a pair of prominent converging bony ridges on anterior part. Preopercle without winglike appendage but with three spines protruding from ventral margin. Body without scales. Cleithral spine long, conical, and sharply pointed. (*Kathetostoma* Günther 1860.)

5*a*. Pectoral rays 13 to 16. Dorsal fin with 2 or 3 distinct oblique black bars. Caudal fin with 2 to 5 horizontally elongated black spots. Upper part of body with distinct rounded or oblong white spots surrounded by dark margins. (North Carolina to Yucatan.)

Kathetostoma albigutta Bean

5*b*. Pectoral rays 17 or 18. Dorsal fin without distinct bars, but with a single, rounded, indistinct blotch. Caudal fin without horizontally elongate black spots, but with a dark broad stripe about middle of fin. Upper part of body without distinct white spots, but irregularly marbled. (Off the Bahamas, Puerto Rico, Cuba, and Honduras.)

Kathetostoma cubana Barbour

Genus *Uranoscopus* Linnaeus

Uranoscopus Linnaeus, Systema naturae, 1758, p. 250. Type species: *Uranoscopus scaber* Linnaeus, 1758, by monotypy.

Uranoscopus occidentalis Agassiz

PLATE 2A

Uranoscopus occidentalis Agassiz *in* Spix, 1831, p. 123, pl. LXXIII (type locality Atlantic Ocean, presumably on the coast of Brazil; type specimen presumably destroyed in the Munich Museum during World War II).—Valenciennes *in* Cuvier and Valenciennes, 1831, p. 492 (described after Agassiz, 1831).—Fowler, 1941, p. 178 (recorded after Agassiz, 1831).

Uranoscopus scaber (non Linnaeus), Kirsch, 1889, p. 261 (in part; reference to Agassiz, 1831; excluding reference to Günther's 1860 *U. occidentalis*).

Not *Uranoscopus occidentalis* Agassiz, Günther, 1860, p. 227 (specimens listed are from Mauritius, and Gulf of Guinea, West Africa).

SPECIMENS EXAMINED: No specimens seen by us.

SYNONOMY: Günther (1860, p. 227) listed as *Uranoscopus occidentalis* a stuffed adult specimen from the "West Indies" and two young specimens from the Gulf of Guinea, West Africa; Fowler (1936, p. 1033) included the reference of the young specimens in the

synonomy of the Eastern Atlantic *Uranoscopus scaber* Linnaeus. G. Palmer of the British Museum (Natural History) in a communication of August 31, 1959, wrote regarding the adult specimen: "On checking the locality for the adult specimen, I find that the old register gives this as Mauritius and not the West Indies. It is part of a collection purchased by the Museum in 1841 from Stevens. The material was collected by Janvier, who certainly did work in the Mauritius area. I think the listing of the locality by Günther as the "West Indies" must be regarded as a *lapsus calami* on his part!" Agassiz's specimen may have been *Uranoscopus scaber* or some other species of *Uranoscopus*, but we record it as a distinct species because no other specimen of *Uranoscopus* has been reported from the American continents, and there is not sufficient evidence to warrant placing it in the synonymy of any other species.

DIAGNOSIS: Dorsal spines four. Dorsal soft rays 14. Anal soft rays 13 or 14. Pectoral rays 16. Lower jaw without a pair of prominent converging bony ridges. Top of head covered with exposed cranial bones. Cleithral spine long, sharp pointed, and protruding through the skin. Body scales present.

COLOR: Spinous dorsal fin black.

RANGE: Brazil (probably in the western South Atlantic), only the type specimen recorded.

Genus *Astroscopus* Brevoort

Astroscopus Brevoort *in* Gill, 1860, p. 20. Type species: *Uranoscopus anolopos* Valenciennes in Cuvier and Valenciennes, 1831, by monotypy.

Astroscopus y-graecum (Cuvier)

PLATES 1,A,C,E,G; 2B

Uranoscopus Y graecum Cuvier *in* Cuvier and Valenciennes, 1829, p. 308 (length quinze pouces; type locality unknown; type specimen deposition unknown).

Uranoscopus anoplos Valenciennes *in* Cuvier and Valenciennes, 1831, p. 493 (length deux pouces; type locality South Carolina from Mt. Le Conte; type specimen in Paris Museum ?).—DeKay, 1842, p. 37, pl. 22, fig. 65 (described; a 2.2-inch specimen from South Carolina collected by Le Conte; excluding reference to a sight record of a 6-inch specimen from New York Harbor).—Storer, 1846, p. 46 (reference after Cuvier and Valenciennes, 1831).

Agnus anoplus, Günther, 1860, p. 229 (reference after Cuvier and Valenciennes, 1831, and DeKay, 1842).

Uranoscopus y-graecum, Günther, 1860, p. 229 (described; an adult specimen from the "West Indies").—Gill, 1861b, p. 21 (referred to the genus *Astroscopus*).

Upselonphorus y-graecum, Gill, 1861a, p. 113 (reference).

Astroscopus anoplus, Gill, 1861a, p. 114 (reference, in part; excluding part of synonymy); 1861b, p. 43 (reference after Storer 1846).—Jordan and Gilbert, 1882, p. 629 (in part; excluding reference to Abbott, 1861, from synonymy).—Jordan, 1884, p. 139 (description; Key West, Fla.).

Astroscopus anolopos, Gill, 1861b, p. 21 (reference of this species to the new genus *Astroscopus* proposed by Brevoort through Gill).—Jordan and Evermann, 1898, p. 2308 (description of *A. anolopos* as a growth stage of *A. y-graecum*).

Astroscopus y-graecum, Bean, 1879, p. 58 (in part; described; St. Johns River, Matansas River Inlet, and Pensacola, Fla.; Charleston, S.C.; excluding record from Hampton Roads, Va.).—Jordan and Gilbert, 1882, pp. 628 and 941 (described); 1883, p. 610 (description; Charleston Harbor, S.C.).—Jordan and Evermann, 1898, p. 2307 (key; described; synonymy); 1900, p. 3301, pl. cccxxxiv, fig. 808 (Matanzas River Inlet, Fla.).—Evermann and Kendall, 1900, p. 92 (references, Fla.).—Smith, 1907, p. 371, fig. 170 (described; Bird Shoal, Beaufort Harbor, N.C.).—Weymouth, 1910, p. 140 (Cameron, La.).—White, 1918, p. 141 (development of electric organs; not distinguished from *A. guttatus*).—Meek and Hildebrand, 1928, p. 908 (small specimens from Atlantic coast of southern U.S. compared to small Pacific *A. zephyreus* Gilbert and Starks).—Hildebrand and Schroeder, 1928, p. 331, fig. 199 (compared with *A. guttatus;* Beaufort, N.C.).—Jordan, Evermann, and Clark, 1930, p. 454 ("South Atlantic Coast, from Cape Hatteras to the Caribbean Sea").—Fowler, 1941, p. 178 (Brazil, compiled); 1945, p. 152 (synonymy in part; Beaufort and New River Inlet, N.C.), p. 223 (Charleston Museum specimens from S.C.), p. 377 (Galveston, Tex.); 1953, p. 54 (Cartagena, Colombia).—Hildebrand, 1954, p. 348 (Texas Coast).—Springer and Bullis, 1956, p. 96 (*Oregon* station 82, 29°21.7′ N., 88°11′ W., 38 fathoms).—Anderson and Gehringer, 1957, p. 55 (34°38′ N., 76°33′ W., at Cape Lookout, N.C.).

Upsilonphorus y-graecum, Jordan, 1884, p. 140 (reference).

Astroscopus anolophus, Baird, 1884, p. 178 (Deal's Island, N.C.).

Anolophus V. graecum, Baird, 1884, p. 178 (reference).

Astroscopus anoplos, Kirsch, 1889, p. 262 (in part; length 1¼ inches, Key West, Fla.; excluding part of range).

Upsilonphorus Y-graecum, Kirsch, 1889, p. 263 (described; Pensacola, Fla., and Beaufort, N.C.).

Astroscopus guttatus (non Abbott), Weymouth, 1910, p. 140 (Cameron, La.).—Dahlgren, 1927, figs. 1 and 3 (these figures only; other references to *A. guttatus* apply or may apply to *A. guttatus*).

Astroscopus Y-graecum, Dahlgren, 1927, p. 364, fig. 11 (life history notes, possibly referable to this species; anatomy).

SPECIMENS EXAMINED

Off Cape Hatteras, N.C., 3 miles SSW of Diamond Shoals Lightship, Mar. 22–25, 1957 (1 specimen), 170 mm. S.L., UNC 2679. Cape Lookout Anchorage, N.C., *Gill* Cr. 4, Nov. 11–12, 1953 (1), 167 mm. SL , BLBG. Gallants Channel at Beaufort railroad bridge, N.C., Jan. 18, 1957 (1), 15.5 mm. S.L , UNC 924. Shackleford Banks, Beaufort, N.C., Sept. 4, 1925 (1), 135 mm. S.L., USNM 185681. Beaufort, N.C., collectors Gudger and Bean (1), 200 mm. S.L., USNM 51912. Beaufort, N.C., collector O. P. Jenkins (1), 84 mm. S.L., CAS (IU No. 6111). Bogue Sound near Swainsboro, N.C., July 17, 1956 (1), 187 mm. S.L., UNC 2370. West shore off Cape Fear River at Southport, N.C., Dec. 12, 1956 (2), 22.5–30 mm. S.L., UNC 866.

North Island at Wingate Bay, S.C., *Fish Hawk* (1), 33 mm. S.L., USNM 59055. Coosan River, S.C. (3), 26–41 mm. S.L., USNM 59083. Coosan River, S.C. (3), 26.5–41 mm. S.L., USNM 59091. South Carolina (2), 29–46.5 mm. S.L., USNM 59033.

Savannah, Ga., collector I. R. Tompkins (4), 32.5–38 mm. S. L., USNM 117198 Off Brunswick, Ga., Feb. 2, 1931, collector W. W. Anderson (1), 41 mm. S.L., USNM 111505. Commercial Trawling Area, Brunswick, Ga., Jan. 16, 1957 (2), 57.5–61 mm. S.L.; Mar. 25, 1959 (1), 59 mm. S.L.; July 13–14, 1959 (1), 120 mm. S.L.; July 14, 1959 (1), 117 mm. S.L.; Oct. 3, 1956 (2), 97.5–112 mm. S.L.; Oct. 20, 1955 (2), 113–127 mm. S.L.; Oct. 22, 1955 (1), 142 mm. S.L.; Nov. 22, 1955 (1), 145 mm. S.L., BLBG. Jekyll Island Causeway, Ga., Nov. 28, 1958 (1), 18 mm. S.L., BLBG. East Beach, St. Simons Island, Ga , Feb. 15, 1956 (1), 18.5 mm. S.L.; Mar. 5, 1957 (1), 25.5 mm. S.L.; Mar. 12, 1959 (1), 28 mm. S.L.; Apr. 13, 1956 (1), 42.5 mm. S.L.; Apr. 16, 1957 (3), 36.5–49.5 mm. S.L.; Apr. 27, 1956 (4), 31.5–47.5 mm. S.L.; May 14, 1956 (3), 44–62 mm. S.L.; May 28, 1956 (4), 41–58 mm. S.L.; July 15, 1957 (1), 81 mm. S.L.; Dec. 19, 1955 (1), 18 mm. S.L.; BLBG. King and Prince Beach, St. Simons Island, Ga., Jan. 15, 1954 (1), 24.5 mm. S.L.; Jan. 16, 1956 (1), 22.4 mm. S.L.; Jan. 27, 1959 (3), 14.5–50 mm. S.L.; Feb. 11, 1959 (1), 19.5 mm. S.L.; Feb. 15, 1956 (1), 25.5 mm. S.L.; Feb. 26, 1959 (1), 19.5 mm. S.L.; Feb. 29, 1956 (1), 48.5 mm. S.L.; Mar. 5, 1957 (10), 42.5–66.5 mm. S.L.; Mar. 15, 1956 (1), 33.5 mm. S.L.; Mar. 18, 1957 (6), 23.5–63.5 mm. S.L.; Apr. 3, 1957 (1), 55 mm. S.L.; Apr. 8, 1955 (1), 24.5 mm. S.L.; Apr. 25, 1955 (1), 30.5 mm. S.L.; May 2, 1957 (2), 60–60.5 mm. S.L.; May 14, 1956 (2), 17–39 mm. S.L.; May 16, 1957 (5), 48.5–68.5 mm. S.L.; May 25, 1959 (1), 22 mm. S L.; May 31, 1957 (2), 51–71 mm. S.L.; June 14, 1957 (1), 69 mm. S L.; Sept. 11, 1957 (1), 124 mm. S.L.; Sept. 16, 1958 (1), 119 mm. S.L.; Nov. 28, 1958 (1), 40 mm. S.L.; Dec. 2, 1955 (1), 49 mm. S.L.; Dec. 4, 1956 (2), 12.5–21.5 mm. S.L.; Dec. 19, 1956 (2), 14.5–39.5 mm. S.L.; Dec. 19, 1955 (2), 12–19 mm. S.L.; BLBG. St. Simons Island, Ga., Nov. 21, 1930 (1), 36 mm. S.L., USNM 119233. Brickhill Creek, Camden County, Ga., Jan. 1931 (13), 33.5–43.5 mm. S.L., USNM 126065.

St. Johns River, Fla., collector S. F. Baird (1), 118 mm. S.L., USNM 18044. West of North Key, Florida Keys, 2.5 fathoms, Mar. 25, 1957 (1), 182 mm. S.L., UF. Key West, Fla. (1), 25 mm. S.L., CAS (IU No. 6344). Key West, Fla., collector D. S. Jordan (1), 24.5 mm. S.L., USNM 35002. Lemon Bay, Fla., summer 1953 (1), 105 mm. S.L., CHML. Lemon Bay at Grove City, Fla., Jan. 28, 1955 (1), 41.5 mm. S.L., CHML. South Englewood Beach, Fla., May 25, 1955 (1), 83 mm. S.L., CHML. Vicinity of Ft. Walton, Fla., summer 1959, collector The Gulfarium (1), 323 mm. S.L., BLBG. Pensacola, Fla., Feb. 9, 1885 (4), 21.3–39 mm. S.L., USNM 132272. Pensacola, Fla., collector Harrison (1), 140 mm. S.L., USNM 44870. Pensacola, Fla., collector Jordan and Stearns (1), 38 mm. S.L., USNM 30851. Florida, collector J. C. Willetts (1), 230 mm. S.L., USNM 18029. 30°12′ N., 88°40′ W., *Silver Bay* Station 167, 4 fathoms, Aug. 28, 1957 (1), 186 mm. S.L., USNM 159669.

Four Bayou Pass, La., Feb. 18, 1933 (1), 42.5 mm. S.L., USNM 185647. Louisiana, Nov. 28, 1931 (5), 23.8–90 mm. S.L., USNM 185669. Off Louisiana coast, 1932 (1), 39 mm. S.L., USNM 156863.

Galveston, Tex., 1941 (1), 120 mm. S.L., USNM 120039. Galveston, Tex., collector D. S. Jordan (1), 50.5 mm. S.L., USNM 30898. Aransas Pass, Corpus Christi, Tex., Nov. 5, 1926 (9), 11.1–17.1 mm. S.L., USNM 185650. Aransas Pass, Tex., Apr. 5, 1927 (1), 144 mm. S.L., USNM 185682. Texas (2), 20–32 mm. S.L., USNM 185675.

Port of Fortaleza, Macuripe, Brazil, Mar. 1945 (1), 48 mm. S.L., SU 52345.

SYNONYMY: *Astroscopus y-graecum* and *A. guttatus* have frequently been confused, due partly to the failure to recognize growth changes in head sculpture in the two species. In earlier years it was due also

to the recognition of a third nominal species of this group, *Astroscopus anolopos*, apparently based on a small specimen of *A. y-graecum* that still had the larval character of the head covered by the exposed cranial bones. We have not examined larval specimens of *A. guttatus* and therefore cannot distinguish them from larval *A. y-graecum* other than by distribution. Larval specimens of *Astroscopus* from the North Carolina coast, where the ranges of the two species are known to overlap, are identified only to genus; specific identifications of larvae from north and south of North Carolina are presumptive. In a publication containing many life history notes and theories, Dahlgren (1927) discussed both *Astroscopus y-graecum* and *A. guttatus* and stated (p. 364): "Where they overlap in the neighborhood of Cape Hatteras it seems practically certain that they interbreed, and great variation is found." Dahlgren did not, however, record his criteria for separation of the two species, and we are convinced that he misidentified some of his specimens (see synonymies).

DIAGNOSIS: Dorsal spines III to V. Dorsal soft rays 13 to 15. Anal soft rays 12 to 14. Pectoral rays 19 to 22. Pelvic rays I, 5. Pelvic girdle without exposed anteriorly directed spines. Top of head covered by exposed cranial bones to about 31 mm. S.L.; in larger sizes the frontal bones exposed posteriorly on the head, with their medial processes forming an exposed Y-shaped process that extends anteriorly between the eyes, and with the area within the fork of the Y and lateral to it covered by skin; with growth the basal arm of the Y becomes long and narrow and the fleshy area becomes comparatively large; least width of the basal arm of the Y about 1.4 to 2.4 percent of standard length at sizes larger than 100 mm. S.L. Posterior nostrils each in a fringed groove curving around behind the eye; posterior end of nostril groove much closer to back of eye than to posterior margin of skin-covered area over electric organs; distance from eye to end of rear nostril groove (a in plate 1G) into distance from end of rear nostril groove to posterior margin of skin-covered area (b in plate 1G) about 1.9 to 11.0 times (in sizes above 40 mm. S.L.). Lower jaw without a pair of prominent converging bony ridges.

Preoperculum and operculum without spines or processes above about 35 mm. S.L. (in smaller sizes the preoperculum has a blunt angle spine, and a bluntly pointed spine is present at the upper anterior margin of the operculum). Cleithral spine small, laterally compressed, covered by skin and adpressed to body. Scales present on body and extending onto fleshy part of caudal fin; scales absent on head, an area posterior to the pectoral fin bases, the throat and abdomen, between the lateral lines and the dorsal fin, and a narrow area along the anal fin base. Lateral lines on each side of body extending from head along back close to dorsal fin, bending down through central part of

caudal base onto fleshy part of caudal fin, then bending anteroventrally to unite at bottom of caudal base.

Color: Body and head generally dark above and light below; tip of lower jaw and upper part of head and body to end of dorsal base with large, irregular, widely spaced white spots having narrow dark margins (these spots not formed on specimens less than about 47 mm. standard length); a dark stripe extending along middle of caudal peduncle; a large elongated black blotch on each side of chin. Spinous dorsal fin black. Soft dorsal fin with from one to three oblique black bars (one bar present between about 50 and 70 mm. standard length, two bars between about 55 and 130 mm., three bars above about 120 mm.). Anal fin with an elongated black stripe extending across most of the softrays (formed between about 53 and 60 mm. standard length). Pectoral fins dusky over most of fin, tending to become black near tip, with a narrow light margin (pigment becoming pronounced at about 50 mm. standard length). Pelvics with an elongated dusky or blackish spot near the distal end of the inner rays (forming at about 110 mm. standard length). Caudal fin with one or three black stripes (one stripe formed at about 40 mm. standard length, three stripes formed at about 55 mm.).

Size: Largest specimen examined, 323 mm. S.L. (440 mm. or 17.5 inches total length). Smallest specimen examined, 12 mm. S.L.

Range: From Cape Hatteras, North Carolina, southward along the United States Atlantic and Gulf coasts and the coast of Central and South America to Santos, Brazil. From recorded specimens this species appears to be an inshore, relatively shallow water inhabitant. Springer and Bullis (1956, p. 96) recorded the species from one *Oregon* station at 38 fathoms from off Alabama—apparently the greatest depth to be recorded.

Astroscopus guttatus Abbott

Plates 1B,D,F; 2C

Astroscopus guttatus Abbott, 1861, p. 365, pl. 7 (type locality Cape May, New Jersey, Beesley's Point ?); type specimen in Academy of Natural Sciences of Philadelphia, No. 22722, about 118 mm. S.L; not *Uranoscopus guttatus* Cuvier 1829, a *Uranoscopus* described from the coast of Pondicherry, India).—Gill, 1861b, p. 43 (reference after Abbott 1861).—Jordan and Evermann, 1898, p. 2307 (key), p. 2310 (description; distinguished from *Astroscopus y-graecum*).—Shufeldt, 1901, pl. VII (photograph).—Fowler, 1906, p. 399 (key), p. 401 (redescription of type specimen from Cape May, 6.5 inches in length).—Evermann and Hildebrand, 1910, p. 163 (Gloucester Point, Va.).—Fowler, 1916, p. 42 (Sandy Hook, N.J.).—White, 1918, p. 141 (development of electric organs; not distinguished from *A. y-graecum*).—Fowler, 1925, p. 45 (Young's Pier, Atlantic City, N.J.); 1926, p. 150 (Longport, N.J.).—Dahlgren, 1927, p. 364, figs. 2, 4–5 (in part; life history notes, possibly referable to this species; excluding figs. 1 and 3 which are *A. y-graecum*).—Nichols and Breder,

1927, p. 156, fig. 228 (accidental distribution in the fall in New York).—Hildebrand and Schroeder, 1928, p. 330, fig. 200 (described; compared with *A. y-graecum;* Lewisetta, Buckroe Beach, Lynnhaven Roads, and Ocean View, Va.).—Jordan, Evermann, and Clark, 1930, p. 454 ("Atlantic coast of the United States, from Long Island to Virginia; not known south of Cape Hatteras").—Pearson, 1941, p. 99, figs. 24–25 (larvae illustrated; Chesapeake Bay, Va.).—Fowler, 1945, p. 72 (synonymy in part; Little Assawoman Bay, Worcester County, Md.).—O'Brien, 1955, p. 90 (photographs).

Upselonphorus guttatus, Gill, 1861a, p. 113 (reference, in part, range incorrect).

Astroscopus anoplus (non Valenciennes), Uhler and Lugger, 1876, p. 83 (synonymy in part; "Occurs occasionally in the southern part of Chesapeake Bay").—Bean, 1879, p. 60 (described; Tompkinsville, N.Y., and Norfolk, Va.).—Jordan and Gilbert, 1882, p. 629 (in part; reference to Abbott, 1861, only), p. 941 (described).

Astroscopus y-graecum (non Cuvier), Bean, 1879, p. 58 (in part; record from Hampton Roads, Va., only).—Fowler, 1906, p. 399, pl. 91 (key to growth stages of *A. guttatus;* description; Atlantic City, N.J., 14-inch specimen).

Upsilonphorus guttatus, Jordan, 1884, p. 140 (reference).—Kirsch, 1889, p. 264 (reference).

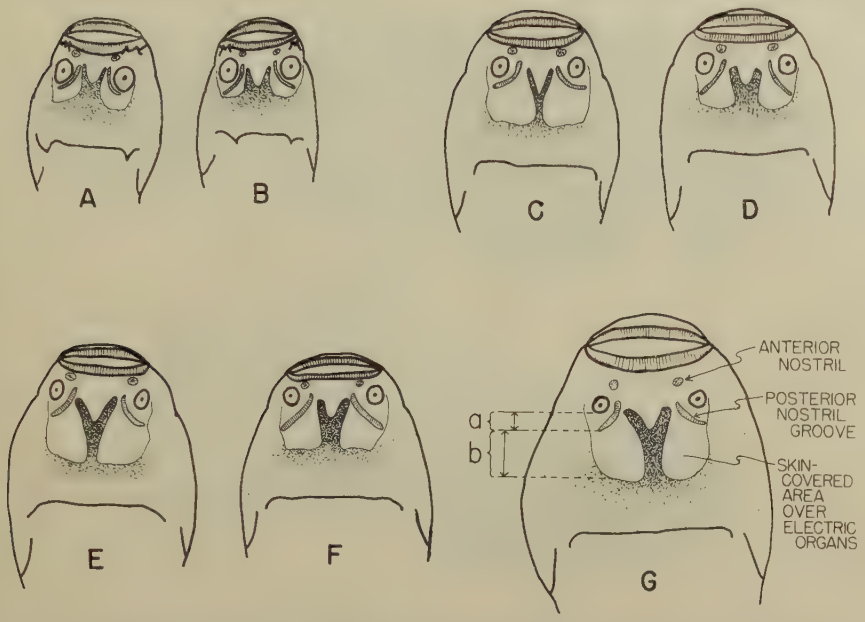
SPECIMENS EXAMINED

Astroscopus guttatus: Rockaway, Long Island, N.Y., collector Blackford (1), 37 mm. S.L., USNM 34628. Tompkinsville, N.Y., collector Charles Copley (1), 80 mm. S.L., USNM 10761. Longport, N.J., Aug. 26, 1887, collector T. H. Bean (1), 48.5 mm. S.L., USNM 45112. Barnegat Bay, N.J., Sept. 19, 1928, collector R. G. Collins (1), 71.5 mm. S.L., USNM 89062. Chesapeake Bay, collector Otto Lugger (3), 43–65.5 mm. S.L., USNM 39347.

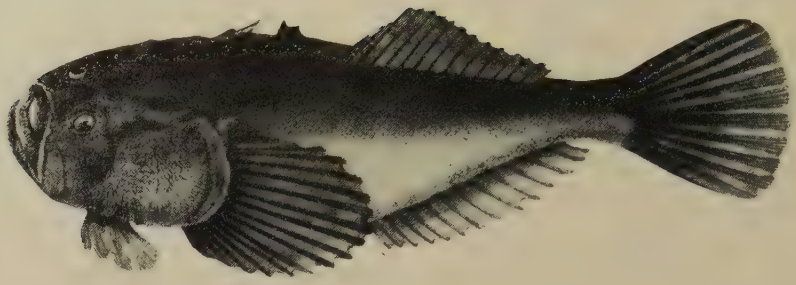
Old Point, Va., Apr. 10, 1922 (1), 70 mm. S.L., USNM 91208. Old Point Comfort, Va., Sept. 11, 1908 (2), 150–155 mm. S.L., USNM 73517. Gloucester Point, York River, Va., *Fish Hawk,* Apr. 3, 1892 (1), 54 mm. S.L., USNM 67917. Buckroe Beach, Va., Oct. 5, 1921 (2), 45–80 mm. S.L., USNM 91209. Off Buckroe Beach, Chesapeake Bay, Va., Apr. 3, 1930 (1), 91.5 mm. S.L., USNM 185668. Fortress Monroe, Va., *Grampus,* June 28, 1892 (1), 95 mm. S.L., USNM 125018. Ocean View, Norfolk, Va., Oct. 16–18, 1922, collector W. C. Schroeder (1), 98 mm. S.L., USNM 91207. Ocean View, Norfolk, Va., Oct. 10–13, 1922 (7), 69.5–105 mm. S.L., USNM 91206. Ocean View, Norfolk, Va., Sept. 5 to Oct. 7, 1922 (7), 58.5–104 mm. S.L., USNM 185683. Norfolk, Va., collector U. Dahlgren (1), 187 mm. S.L., USNM 57830. Norfolk, Va. (1), 207 mm. S.L., USNM 4622. The Cape, N.C., collector M. Corbel (1), 215 mm. S.L., USNM 32754. Off Cape Hatteras, N.C., 10–20 fathoms, Dec. 5, 1930 (1), 197 mm. S.L., USNM 185684. Cape Lookout, N.C., collector Coles (1), 119 mm. S.L., USNM 74308.

Astroscopus sp.: 35°25′30″ N., 75°25′00″ W., *Albatross* station 2286, Oct. 19, 1884 (1), 34 mm. S.L., USNM 131500. 35°22′50″ N., 75°25′00″ W., *Albatross* station 2289 (1), 22.8 mm. S.L., USNM 148208. Mouth of canal, Beaufort, N.C., Feb. 13, 1930 (1), 25.2 mm. S.L., USNM 153674. Mouth of canal, Beaufort, N.C., Mar. 13, 1931 (1), 24.2 mm. S.L., USNM 153675. Newport River, Beaufort, N.C., Jan. 2, 1930 (1), 23.7 mm. S.L., USNM 153676.

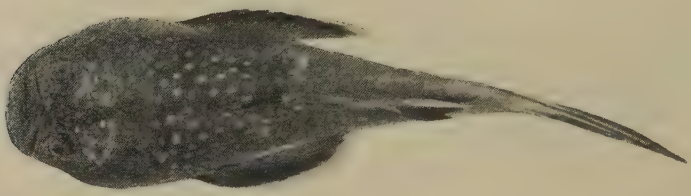
DIAGNOSIS: Dorsal spines IV or V. Dorsal soft rays 13 to 15. Anal soft rays 13 or 14. Pectoral rays 19 to 21. Pelvic rays I, 5. Pelvic girdle without exposed anteriorly directed spines. Top of head covered by exposed cranial bones at small sizes (at 23 mm. T.L., fide



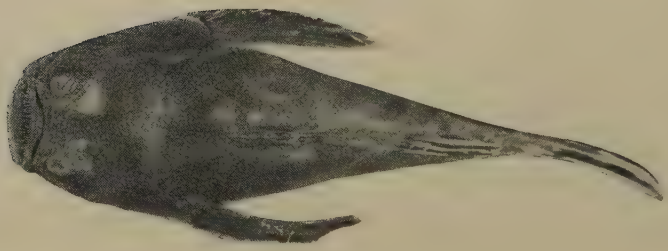
Diagrammatic dorsal view of heads of *Astroscopus y-graecum* and *Astroscopus guttatus* illustrating growth changes in shape or relative position of the Y-shaped processes of the frontal bones, the posterior nostril groove and the area of skin covering the electric organs. *Astroscopus y-graecum:* A, 45 mm. S.L.; C, 112 mm. S.L.; E, 14 inches total length; G, 323 mm. S.L. (17.5 inches total length). *Astroscopus guttatus:* B, 45 mm. S.L.; D, 98 mm. S.L.; F, 12 inches total length. E and F modified from Dahlgren (1927, figs. 4 and 11). The measurements shown in G are: a, distance from eye to rear end of posterior nostril groove; b, distance from rear and of posterior nostril groove to posterior margin of skin-covered area.



A

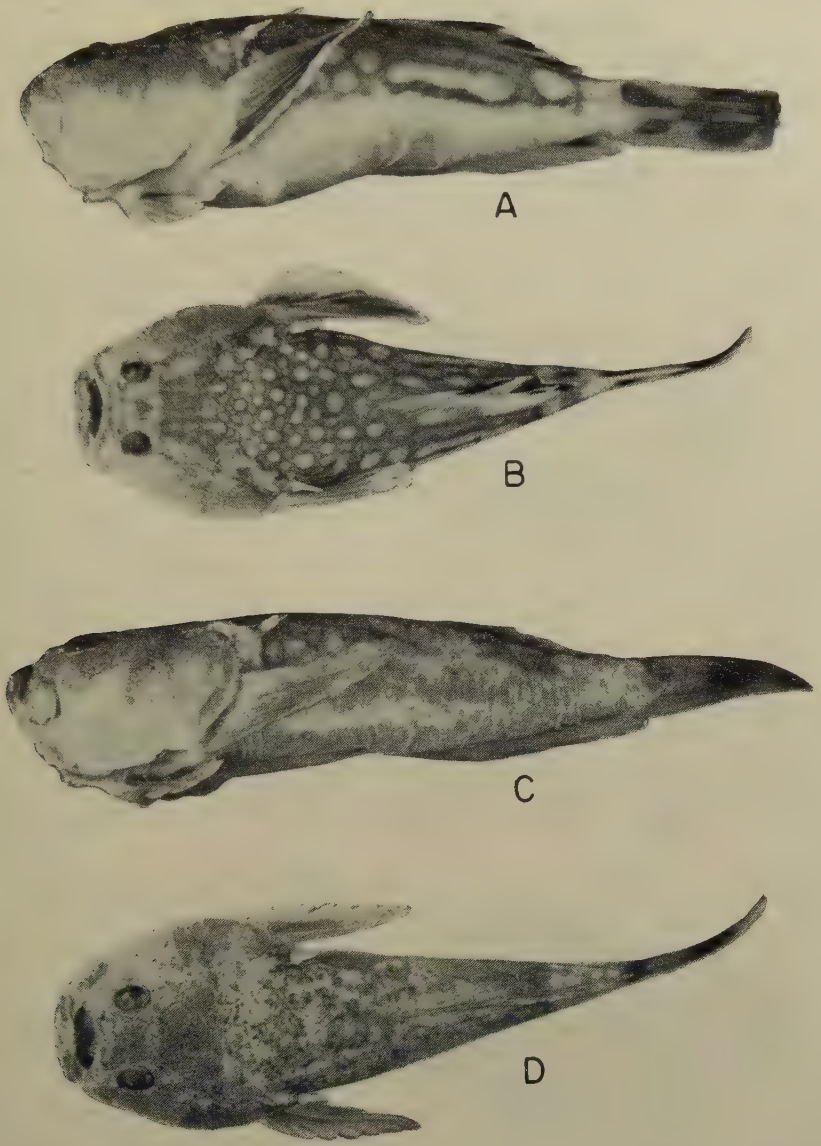


B

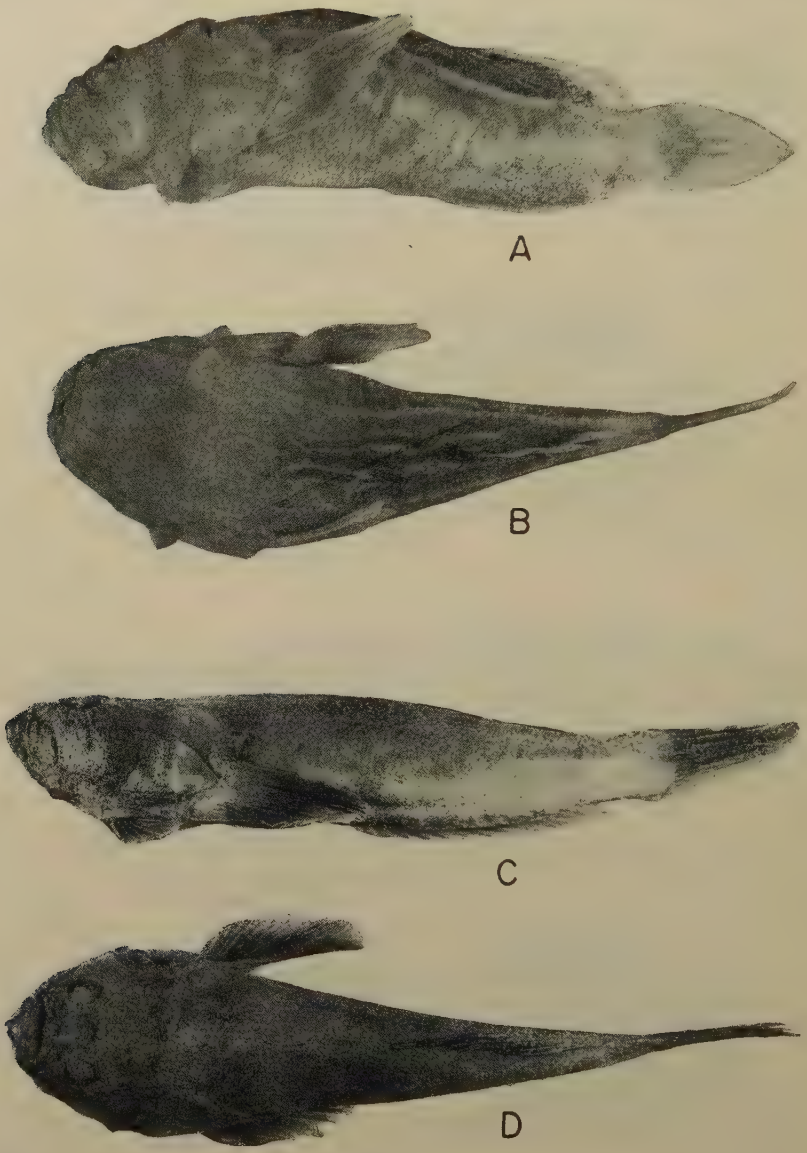


C

A, *Uranoscopus occidentalis*, drawing of the type, after Agassiz *in* Spix (1831, pl. LXXIII). B, *Astroscopus y-graecum*, 100 mm. S.L., Brunswick, Ga., BLBG. C, *Astroscopus guttatus*, 98 mm. S.L., Norfolk, Va., USNM 91207.



A and B, *Kathetostoma albigutta*, 113 mm. S.L., *Combat* station 454, 25°13′ N., 80°10′ W., BLBG. C and D, *Kathetostoma cubana*, 119 mm. S.L., *Silver Bay* station 441, 27°39′ N., 79°15′ W., BLBG.



Gnathagnus egregius: A and B, 76 mm. S.L., *Oregon* station 265, 29°20′ N., 87°42′ W., CNHM 46649. C and D, 243 mm. S.L., *Oregon* stations 472 through 478, Gulf of Mexico off Mississippi Delta, CNHM 46651.

Pearson 1941, p. 98, fig. 25); in larger sizes (at least by 43 mm. S.L.) the frontal bones exposed posteriorly on the head, with their medial processes forming an exposed Y-shaped process that extends anteriorly to between or just behind the eyes, and with the area within the fork of the Y and lateral to it covered by skin; in large specimens the basal arm of the Y short and broad and the skin-covered area only moderately enlarged; least width of the basal arm of the Y about 2.5 to 3.8 percent of standard length in sizes larger than 100 mm. S.L. Posterior nostrils each in a fringed groove curving around behind the eye; posterior end of nostril groove usually closer to posterior margin of skin-covered area over electric organs than to eye or not much closer to eye; distance from eye to end of rear nostril groove (a in plate 1G) into distance from end of rear nostril groove to posterior margin of skin-covered area (b in plate 1G) about 0.5 to 1.6 times (at sizes above 40 mm. S.L.). Lower jaw without a pair of prominent converging bony ridges.

Preoperculum and operculum without spines or processes. Cleithral spine small, laterally compressed, covered by skin and adpressed to body. Scales present on body and extending onto fleshy part of caudal fin; scales absent on head, an area posterior to the pectoral fin bases, the throat and abdomen, between the lateral lines and the dorsal fin, and a narrow area along the anal fin base. Lateral lines on each side of body extending from head along back close to dorsal fin, bending down through central part of caudal base onto fleshy part of caudal fin, then bending anterioventrally to unite at bottom of caudal base.

Color: Body and head generally dusky above and light below; tip of lower jaw and upper part of head and body to end of dorsal base with many small and irregular white spots; a dark stripe extending along middle of caudal peduncle; a large elongated black blotch on each side of chin. Spinous dorsal fin black. Soft dorsal fin with about 4 oblique black bars. Anal fin with an elongated blackish stripe extending across most of the soft rays. Pectoral fins dusky over most of fin, tending to become black near tip, and with a narrow light margin. Pelvic fins mostly clear with a dusky or dark spot between distal ends of last two rays. Caudal fin with about three black stripes.

Size: Largest specimen reported, 12¼ inches total length (about 220 mm. S.L.), from Chesapeake Bay (Hildebrand and Schroeder, 1927, p. 331). Smallest specimens reported, 2.5 to 5 mm. T.L. and 23 mm. T.L. (Pearson, 1941, p. 98, figs. 24–25). Largest specimen examined 215 mm. S.L. Smallest specimen examined 37 mm. S.L. Dahlgren (1927, p. 358) reported specimens as *Astroscopus* (presumably this species) from several miles off the Virginia coast that were up to 22 inches in total length and weighed up to 15 or 20 pounds.

RANGE: From Long Island, New York, to Cape Lookout, North Carolina. This species primarily inhabits inshore, shallow, sandy areas. Dahlgren (1927, p. 362) speculated that larger individuals spawned at depths of 30 to 200 feet.

Genus *Kathetostoma* Günther

Kathetostoma Günther, 1860, p. 231. Type species: *Uranoscopus laevis* Bloch and Schneider, 1801, by monotypy.

Kathetostoma albigutta Bean

PLATE 3A-B

Cathetostoma albigutta Bean, 1892, p. 121 (type specimens in U.S. National Museum. Type locality *Albatross* station 2403, 28°42′30″ N., 85°29′00″ W., 88 fathoms, USNM 39304, holotype 119 mm. S.L. and one paratype 115 mm. S.L. Paratypes from *Albatross* station 2404, 28°44′ N., 85°16′ W., 60 fathoms, USNM 39305 (2), 85 and 113 mm. S.L.; *Albatross* station 2410, 26°47′30″ N., 83°25′15″ W., 28 fathoms, USNM 39306 (1), 95 mm. S.L.; and *Albatross* station 2411, 26°33′30″ N., 83°15′30″ W., 27 fathoms, USNM 39307 (1), 27.5 mm. S.L.).

Kathetostoma albigutta, Jordan and Evermann, 1898, p. 2311 (key), p. 2312 (described; incorrectly stated that only one specimen known; dorsal and anal ray counts incorrect); 1900, p. 3301, pl. CCCXXXIV, figs. 809, 809a (type specimen illustrated).—Longley and Hildebrand, 1940, p. 267 (reference).—Barbour, 1941, p. 1 (reference to holotype).—Longley and Hildebrand, 1941, p. 245 (described; off Tortugas, Fla., 67 to 88 fathoms).—Hildebrand, 1954, p. 317 (off Gulf coast of Texas and northern Mexico).—Springer and Bullis, 1956, p. 97 (*Oregon* stations in the Gulf of Mexico).

Kathetostoma albiguttum, Evermann and Kendall, 1900, p. 92 (reference to type specimen localities).

SPECIMENS EXAMINED

34°52′ N., 75°27′ W., *Silver Bay* station 1283, 98 fathoms, Sept. 17, 1959 (1), 115 mm. S.L., BLBG. 34°48′ N., 75°33′ W. to 34°45.5′ N., 75°28′ W., *Albatross* III station 35, tow 1, 42–48 fathoms, June 3, 1945 (1), 80 mm. S.L., USNM 151918. 34°32′ N., 75°58′ W. to 34°34′ N., 75°58′ W., *Albatross* III Cr. 21, station 5, tow 1, 23–25 fathoms, June 8, 1949 (2), 120–121 mm. S.L., USNM 151923. 34°23′ N., 76°03′ W., *Combat* station 408, 30 fathoms, June 22, 1957 (1), 105 mm. S.L., USNM 159644. 34°17′ N., 76°01′ W., *Combat* station 406, 45 fathoms, June 21, 1957 (1), 36 mm. S.L., BLBG. 34°17′ N., 76°01′ W., *Combat* station 406 (1), 117 mm. S.L., USNM 159646. 34°11′ N., 76°18′ W., *Pelican* station 187–2, 22 fathoms, Feb. 27, 1940 (1), 90.5 mm. S.L., USNM 185649. 33°55.5′ N., 76°23′ W., to 33°59′ N., 76°20′ W., *Albatross* III Cr. 31–A, station 1, tow 4, 78 fathoms, Jan. 18, 1950 (2), 116–126 mm. S.L., USNM 151935.

Southeast of North Edisto River sea buoy, S.C., 20 fathoms, Feb. 24, 1958 (1), 105 mm. S.L., CM 58.2.19. 32°34′ N., 78°46′ W., *Combat* station 424, 24 fathoms, June 24, 1957 (1), 104 mm. S.L., TU 17087. 32°26′ N., 79°03′ W., *Combat* station 167, 23 fathoms, Nov. 1, 1956 (1), 106 mm. S.L., UF 7229. 32°05′ N., 79°40′ W., *Combat* station 514, 22–25 fathoms, Oct. 7, 1957 (1), 110 mm. S.L., USNM 159645. 31°55′ N., 79°35′ W., *Combat* station 518, 38–43 fathoms, Oct. 8, 1957 (1), 162 mm. S.L., TU 17552. 31°49′ N., 79°31′ W., *Combat* station 519, 45 fathoms, Oct. 8, 1957 (1), 88 mm. S.L., TU 17561. 31°38′ N., 79°40′ W., *Combat* station

526, 41–45 fathoms, Oct. 8, 1957 (1), 82 mm. S.L., TU 17600. 31°29′ N., 79°33′ W., *Combat* station 512, 60 fathoms, Oct. 3, 1958 (1), 115 mm. S.L., USNM 159097. 31°18′ N., 79°45′ W., *Combat* station 528, 100 fathoms, Oct. 9, 1957 (2), 118–157 mm. S.L., TU 17556. 31°00.5′ N., 80°01.5′ W., *Pelican* station 198–1, 40 fathoms, Mar. 15, 1940 (1), 29 mm. S.L., USNM 185666.

20 to 50 fathom contour from point north of Jacksonville, Fla., to a point south of Brunswick, Ga., *Bowers*, Jan. 1956, collector James D. Regan (1), 121 mm. S.L., UMML 5. 30°13′ N., 80°23′ W., *Combat* station 497, 25 fathoms, Aug. 20, 1957 (1), 94.5 mm. S.L., BLBG. 29°30′ N., 80°13′ W., *Combat* station 488, 50 fathoms, Aug. 19, 1957 (3), 99–107 mm. S.L., BLBG. 29°15′ N., 80°13′ W., *Combat* station 334, 30 fathoms, June 1, 1957 (1), 85 mm. S.L., BLBG. 29°03′ N., 80°13′ W., *Combat* station 335, 28 fathoms, June 1, 1957 (1), 147 mm. S.L., USNM 159389. 28°58′ N., 80°13′ W., *Combat* station 333, 30 fathoms, June 1, 1957 (3), 102–144 mm. S.L., BLBG. 25°13′ N., 80°10′ W., *Combat* station 454, 85 fathoms, July 26, 1957 (6), 87.5–142 mm. S.L., BLBG. South of Tortugas, Fla., collector W. H. Longley (6), 72.5–113 mm. S.L., USNM 92057.

Tortugas, Fla., collector W. H. Longley (4), 80–101 mm. S.L., USNM 117281. 24°47′ N., 83°13′ W., *Oregon* station 1020, 35 fathoms, Apr. 19, 1954 (1), 96 mm. S.L., USNM 185648. 26°33′30″ N., 83°15′30″ W., *Albatross* station 2411, 27 fathoms (1 paratype), 27.5 mm. S.L., USNM 39307. 24°25′ N., 83°22′ W., *Oregon* station 1548, 210 fathoms, June 17, 1956 (1), 90 mm. S.L., TU 12683. 26°47′30″ N., 83°25′15″ W., *Albatross* station 2410, 28 fathoms (1 paratype), 95 mm. S.L., USNM 39306. 27°30′ N., 84°14′ W., *Oregon* station 937, 38 fathoms, Mar. 18, 1954 (1), 105 mm. S.L., UF 3708. 28°44′ N., 85°16′ W., *Albatross* station 2404, 60 fathoms (2 paratypes), 85–113 mm. S L., USNM 39305. 28°47′ N., 85°19′ W., *Oregon* station 895, 64 fathoms, Mar. 7, 1956 (3), 88.5–111 mm. S.L., TU 12959. 28°42′30″ N., 85°29′ W., *Albatross* station 2403, 88 fathoms (holotype and 1 paratype), 119–115 mm. S.L., USNM 39304. 29°07.5′ N., 85°40.5 W., *Pelican* station 154–3, 50 fathoms, Mar. 10, 1939 (1), 72 mm. S.L., USNM 185646.

29°36′ N., 85°54′ W., *Silver Bay* station 160, 21–22 fathoms, Aug. 23, 1957 (1), 136 mm. S.L., USNM 159658. 29°32′ N., 86°04′ W., *Silver Bay* station 158, 40 fathoms, Aug. 23, 1957 (3), 110–122 mm. S.L., USNM 159660. 29°47′ N., 86°28.5′ W., *Pelican* station 143–3, 60 fathoms, Mar. 5, 1939 (1), 113 mm. S.L., USNM 185680. 29°50′ N., 86°35′ W., *Silver Bay* station 316, 60–75 fathoms, Mar. 16, 1958 (1), 108 mm. S.L., BLBG. 30°03′ N., 86°50′ W., *Silver Bay* station 312, 55 fathoms, Mar. 16, 1958 (1), 101 mm. S.L., BLBG. 30°03′ N., 86°50′ W., *Silver Bay* station 312 (1), 204 mm. S.L., TU 17561. 30°03′ N., 86°56′ W., *Oregon* station 331, 60 fathoms, May 4, 1951 (1), 98.5 mm. S.L., USNM 186170. 28°11′ N., 91°24.5′ W., *Pelican* station 85–4, 47 fathoms, July 12, 1938 (1), 96.5 mm. S.L., USNM 185671. 28°09′ N., 91°32′ W., *Pelican* station 85–2, 49 fathoms, July 12, 1938 (1), 111 mm. S.L., USNM 185670.

27°45′ N., 96°13′ W., *Pelican* station 108–10, 39 fathoms, Jan. 23, 1939 (2), 84.5–92 mm. S.L., USNM 185673. 27°24.5′ N., 96°13′ W., *Pelican* station 40, 90 fathoms, Apr. 21, 1938 (1), 108 mm. S.L., USNM 185672. 27°29′ N., 96°16′ W., *Oregon* station 159, 58 fathoms, Nov. 27, 1950 (1), 85 mm. S.L., TU 2674. 27°27′ N., 96° 17′ W., *Oregon* station 158, 65 fathoms, Nov. 27, 1950 (4), 102–145 mm. S.L., USNM 185685. 27°17.5′ N., 96°25′ W., *Pelican* station 111–4, 75 fathoms, Jan. 30, 1939 (2), 78–92.5 mm. S.L., USNM 185667. 26°10′ N., 96°40′ W., *Oregon* station 1087, 29 fathoms, June 3, 1954 (1), 86 mm. S.L., UF 7228. 26°10′ N., 96°40′ W., *Oregon* station 1087 (1), 136 mm. S.L., TU 10643. Brownsville, Texas (1), 119 mm. S.L., USNM 171762. 23°36′ N., 87°54′ W., *Silver Bay* station 438, 68 fathoms, May 18, 1958 (3), 109–141 mm. S.L., BLBG.

DIAGNOSIS: No spinous dorsal fin. Dorsal soft rays 13 to 15. Anal soft rays 12 to 15. Pectoral rays 14 to 16. Pelvic rays I, 5, the spine obscured by skin. Pelvic girdle with paired anterior processes of conical spines protruding through the skin. Top of head covered by exposed cranial bones; a shallow anterior recess of the frontal bones between the eyes. Posterior nostrils not in fringed grooves. Lower jaw without a pair of prominent converging bony ridges. Preoperculum with three spines extending from ventral margin; operculum without a spine. Cleithral spine prominent, conical, sharply pointed, and extending posterodorsally. No scales present (scalelike structures present in lateral line). Lateral lines on each side of body extending from head along back close to dorsal fin, bending down to middle of caudal base, and ending between and nearly at ends of central caudal rays.

COLOR: Lower half of body whitish. Upper half of body with rounded white spots on brownish background, margins of the spots of darker brown, the spots confined mainly to predorsal area on small specimens, on large specimens the posterior spots larger and elongate. Pectoral fins with brownish black pigment across the fins. Pelvics clear. Anal fin with small area of pigment at posterior base. Dorsal fin with two to five and caudal fin with three or more blackish elongated spots, the spots more numerous in larger specimens.

SIZE: Largest specimen examined 204 mm. S.L. (about 10.2 inches T.L.). Smallest specimen examined 29 mm. S.L. A 21-mm. S.L. specimen is identified only to genus, because it lacks distinctive pigmentation and the pectoral fins are damaged.

RANGE: From Cape Lookout, N.C., to the Florida Keys and around the Gulf of Mexico to Campeche Bank off Yucatan. Depth records of all but one of the known specimens range from 22 to 100 fathoms, with the majority of these records between 30 and 60 fathoms. One specimen was recorded from 210 fathoms south of the Florida Keys where the Continental Shelf is very steep.

Kathetostoma cubana Barbour

PLATE 3C-D

Kathetostoma albigutta cubana Barbour, 1941, p. 2 (type locality *Atlantis* station 3421 off the northern coast of Cuba. Holotype and 13 paratypes in Museum of Comparative Zoology, Nos. 35506, 35508, 35510, 35511, 35512, 35513, and 35514; 2 paratypes in U.S. National Museum, No. 153586; 2 paratypes sent to Museo Poey, Havana).

SPECIMENS EXAMINED

Kathetostoma cubana: 27°39′ N., 79°15′ W., *Silver Bay* station 441, 275–300 fathoms, June 9, 1958 (2), 67.5–119 mm. S.L., BLBG. 24°04′ N., 79°15′ W., *Combat* station 448, 250 fathoms, July 24, 1957 (1), 54.5 mm. S.L., BLBG. 24°04′ N., 79°15′ W., *Combat* station 448, 250 fathoms, July 24, 1957 (1), 55 mm.

S.L., USNM 159650. 22°50′ N., 79°08′ W., *Oregon* station 1344, 200–225 fathoms, July 16, 1955 (1), 66 mm. S.L., USNM 157986. 22°48′ N., 79°09′ W., *Atlantis* station 3422, 235 fathoms, Apr. 30, 1939 (3 paratypes), 86.5–118 mm. S.L., MCZ 35513. 22°50′ N., 78°55′ W., *Atlantis* station 3416, 200 fathoms, Apr. 30, 1939 (2 paratypes), 70.5–75 mm. S.L., USNM 153586. 16°39′ N., 81°43′ W., *Oregon* station 1878, 125 fathoms, Aug. 22, 1957 (1), 98 mm. S.L., UMML 4793. 16°39′ N., 82°29′ W., *Oregon* station 1870, 225 fathoms, Aug. 21, 1957 (1), 128 mm. S.L., TU 18848. 18°30′ N., 65°59′ W., *Oregon* station 2603, 230 fathoms, Sept. 25, 1959 (1), 85 mm. SL., USNM 195569.

Kathetostoma sp.: 27°49′ N., 84°12′ W., *Oregon* station 939, 35 fathoms, Mar. 18, 1934 (1), 21 mm. S.L., USNM 185674.

Synonymy: Barbour (1941, p. 1), apparently noting only color differences, described *K. cubana* as a subspecies of *K. albigutta*. Because of the consistent and discrete color differences, differences in pectoral ray counts and geographical and depth distribution, and differences in modal numbers of anal soft rays, we evaluate *K. cubana* as a distinct species.

Diagnosis: No spinous dorsal fin. Dorsal soft rays 13 to 15. Anal soft rays 13 or 14. Pectoral rays 17 or 18. Pelvic rays I, 5, the spine obscured by skin. Pelvic girdle with paired anterior processes of conical spines protruding through the skin. Top of head covered by exposed cranial bones; a shallow anterior recess of the frontal bones between the eyes. Posterior nostrils not in fringed grooves. Lower jaw without a pair of prominent converging bony ridges. Preoperculum with three spines extending from ventral margin; operculum without a spine. Cleithral spine prominent, conical, sharply pointed, and extending posterodorsally. No scales present (scalelike structures present in lateral line). Lateral lines on each side of body extending from head along back close to dorsal fin, bending down to middle of caudal base, and ending between and nearly at ends of central caudal rays. Barbour (1941, p. 2) recorded fin counts as "usually with D. 11 and A. 11," but we have examined five paratypes and six other specimens in which the counts are consistently higher.

Color: Ventral part of body unpigmented, sides of body and head with faint pigment, dorsal surface of body and head mottled with irregular dull brown spots. Pelvic and anal fins unpigmented. Pectoral fins faintly pigmented. Dorsal fin faintly pigmented along the rays. Caudal fin with faintly pigmented spot on upper part of base and a broad darker blackish stripe located about middle of fin.

Size: Largest specimen reported about 146 mm. S.L. (7.75 inches T.L.). Smallest specimen examined 54.5 mm. S.L.

Range: Off the Little Bahama Banks, the Grand Bahama Banks, the northern coast of Cuba, off eastern Puerto Rico, and in the Caribbean off eastern Honduras. All the known specimens but one have

been taken between depths of 180 and 300 fathoms; the other record was from 125 fathoms off Honduras. The type localities for *K. eubono* have not been published, and are furnished through the courtesy of Myvanwy M. Dick of the Museum of Comparative Zoology. They are all from off the north central coast of Cuba: *Atlantis* station 3392, 22°35′ N., 78°16′ W., 225 fathoms; *Atlantis* station 3396, 22°34′ N., 78°15′ W., 180 fathoms; *Atlantis* station 3414, 22°30′30″ N., 78°32′ W., 230 fathoms; *Atlantis* station 3416, 22°50′ N., 78°35′ W., 200 fathoms; *Atlantis* station 3421, 22°49′ N., 79°07′ W., 255 fathoms; *Atlantis* station 3422, 22°48′ N., 79°09′ W., 255 fathoms; *Atlantis* station 3423, 22°50′ N., 79°08′ W., 245 fathoms; *Atlantis* station 3437, 23°05′ N., 78°16′ W., 260 fathoms.

Genus *Gnathagnus* Gill

Gnathagnus Gill, 1861, p. 115. Type species: *Uranoscopus elongatus* Temminck and Schlegel, 1844, by monotypy.

Gnathagnus egregius (Jordan and Thompson)

PLATE 4

Ezecestides egregius Jordan and Thompson, 1905, p. 258, figs. 5–6 (type locality reef at Garden Key, Tortugas, Fla. Type specimen in Stanford University Natural History Museum, SU 8410.—Longley and Hildebrand, 1940, p. 267 (reference), 1941, p. 244 (described after Jordan and Thompson, 1905).—Hildebrand, 1954, p. 318 ("24-10 grounds" off northern Gulf coast of Mexico, between 21 and 31 fathoms, specimen 87 mm. long).

Benthoscopus laticeps Longley and Hildebrand, 1940, p. 264, figs. 20–21 (type locality off Tortugas, Fla., between 90 and 175 fathoms, type specimen in U.S. National Museum, USNM 108879; 1941, p. 244 (reference).—Springer and Bullis, 1956, p. 97 (*Oregon* stations in the Gulf of Mexico).

Gnathagnus laticeps, Myers, 1946, p. 42 (generic relationship).

SPECIMENS EXAMINED

31°50′ N., 79°14′ W., *Combat* station 304, 180 fathoms, Apr. 22, 1957 (2), 197 mm. S.L., BLBG. 29°46′ N., 80°13′ W., *Combat* station 9, 200 fathoms, July 29, 1956 (1), 197 mm. S.L., GWM acct. Dinner Key, Biscayne Bay, Dade County, Fla., Mar. 1956, collector Fofield (1), 57.5 mm. S.L., UMML 747. Off Tortugas, Fla., between 90 and 175 fathoms, collector Longley (holotype of *Benthoscopus laticeps*), 200 mm. S.L., USNM 108879. 24°20′ N., 83°20′ W., *Oregon* station 1005, 190 fathoms, Apr. 13, 1954 (2), 119–186 mm. S.L., GWM acct. 24°28′ N., 83°25′ W., *Oregon* station 1011, 200 fathoms, April 14, 1954 (1), 193 mm. S.L., CNHM 61325. 24°29′ N., 83°32′ W., *Oregon* station 1038, 200 fathoms, June 15, 1956 (1), 145 mm. S.L., TU 12716. 29°16′ N., 86°10′ W., *Oregon* station 1885, 125 fathoms, Sept. 7, 1955 (1), 113 mm. S.L., USNM 188528. 29°37′ N., 86°37.5′ W., *Oregon* station 326, 82 fathoms, Apr. 30, 1951 (1), 87 mm. S.L., GWM acct. No. 190888. 29°38′ N., 87°16.5′ W., *Oregon* station 281, 112 fathoms, Feb. 25, 1951 (1), 71.5 mm. S.L., CNHM 46648.

29°38′ N., 87°16.5′ W., *Oregon* station 281, 112 fathoms, Feb. 25, 1951 (1), 131 mm. S.L., GWM acct. No. 188454. 29°38′ N., 87°16.5′ W., *Oregon* station 281, 112 fathoms, Feb. 25, 1951 (1), 79 mm. S.L., USNM acct. No. 187055, GWM

acct. No. 188434. 29°23′ N., 87°25′ W., *Oregon* station 270, 220 fathoms, Feb. 17, 1951 (1), 226 mm. S.L., GWM acct. No. 188434. 29°20′ N., 87°42′ W., *Oregon* station 265, 101 fathoms, Feb. 16, 1951 (1), 117 mm. S.L., CNHM 46650. 29°20′ N., 87°42′ W., *Oregon* station 265, 101 fathoms, Feb. 16, 1951 (1), 76 mm. S.L., CNHM 46649. 29°20′ N., 87°42′ W., *Oregon* station 265, 101 fathoms, Feb. 16, 1951 (1), 78.5 mm. S.L., GWM acct. No. 188434. 29°15.5′ N., 87°53′ W., *Oregon* station 314, 175 fathoms, Apr. 27, 1951 (1), 200 mm. S.L., GWM acct. No. 190888. 29°12′ N., 88°05′ W., *Oregon* station 637, 195 fathoms, Sept. 18, 1952 (1), 175 mm. S.L., TU 6834.

29°13.5′ N., 88°12′ W., *Oregon* station 2203, 125 fathoms, June 26, 1958 (5), 111–127 mm. S.L., BLBG. 29°03′ N., 88°25′ W., *Oregon* station 1107, 210–235 fathoms, June 15, 1954 (1), 175 mm. S.L., TU 12868. 28°57′ N., 88°40.5′ W., *Oregon* station 481, 210 fathoms, Sept. 7, 1951 (2), 211–229 mm. S.L., GWM acct. No. 190888. Between 29°05′ N., 88°31′ W., and 28°56.5′ N., 88°40′ W., *Oregon* stations 472 to 484, between 185 and 240 fathoms, Sept. 6–7, 1951 (2), 166–243 mm. S.L., CNHM 46651. 29°00′ N., 88°48′ W., *Oregon* station 93, 122 fathoms, Aug. 24, 1950 (1), 138 mm. S.L., GWM acct. No. 185983. 27°38′ N., 95°35′ W., *Oregon* station 1509, 225 fathoms, May 7, 1956 (1), 122 mm. S.L., TU 12807. 27°15′ N., 96°24′ W., *Pelican* station 112–1, 80 fathoms, Jan. 30, 1939 (1), 76.5 mm. S.L., GWM *Pelican* acct. No. 186572.

Synonymy: We adhere to Myers' (1946, p. 42) decision in placing *Benthoscopus laticeps* in the genus *Gnathagnus* Gill. We include *Execestides* Jordan and Thompson in the synonymy of *Gnathagnus*. The major recorded difference between *G. laticeps* and *Execestides egregius* was that the former had scales, the latter was scaleless. Our specimens of *Gnathagnus*, ranging from 243 mm. S.L. down to 57.5 mm. S.L., showed a pronounced structural ontogeny, and the presence of scales on all of these confirmed their identification as *G. laticeps*. George S. Myers, Margaret Storey, and Stanley H. Weitzman of the Stanford University Natural History Museum cooperated in furnishing us with information on the small type specimen of *E. egregius*, reported to lack scales. A portion of mucous scraped from the side near the peduncle of the type was stained with alizarin and a small scale was found to be present in the scrapings, presumptive evidence that the type specimen has small, hidden scales and supporting our placing *G. laticeps* in the synonymy of *E. egregius* in the genus *Gnathagnus*.

Diagnosis: No spinous dorsal fin. Dorsal soft rays 12 to 14. Anal soft rays 16 or 17. Pectoral rays 20 to 24. Pelvic rays I, 5. Pelvic girdle without exposed anteriorly directed spines. Top of head covered by exposed cranial bones; a shallow anterior recess of the frontal bones between the eyes. Posterior nostrils not in fringed grooves. Lower jaw with the dentary bones forming a pair of prominent converging bony ridges on the anterior part, deeply notched between. Preoperculum with a flattened process, usually bluntly pointed, extending posteriolaterally from across angle of the bone, diminishing with growth; operculum striated and ridged and ending

in a spine which diminishes with growth. Cleithral spine prominent, laterally compressed, and curved posteriodorsally. Scales present on body and extending onto fleshy part of caudal fin; scales absent on head, an area posterior to pectoral fin bases, the throat and abdomen, a small area posterior to the bones on top of the head, and a narrow area along the anal fin base; the scales small and deeply embedded in smaller specimens (the largest scale found on a 57.5-mm. specimen had a maximum diameter of 0.19 mm.). Lateral lines on each side of body extending from head along back close to dorsal fin, bending down to middle of caudal base, and ending between and nearly at ends of central caudal rays.

Color: At about 47 mm. S.L. (holotype description), body color blackish, fins pale with a blackish area at base of each, a pale streak along lateral line and one across base of dorsal. From 57.5 to 71.5 mm. S.L., head and dorsal half of body with irregular dark blotches tending to form broken stripes on back, scattered small pigment spots on rest of body, pelvics with spots at bases, other fins dark near bases. By 76 mm. S.L., head no longer dark spotted. By 87 mm. S.L., about the proximal three-fourths of the pectoral, dorsal, anal, and caudal fins are darkened, and the body has taken on a brownish cast. By 113 mm. S.L., the coloration of the upper half of the body consists of numerous small pigment spots, on some specimens these coalesce in some areas to form short lines.

Size: Largest specimen examined, 13 inches T.L. (243 mm. S.L.). Smallest specimen reported, 2⅓ inches total length (the holotype, about 47 mm. S.L.).

Range: All known specimens have been taken from off the coast of the United States: From off northern Georgia, eastern Florida, Tortugas and northwestern Florida, Alabama, Mississippi, and southern Texas. Of the specimens we examined, those larger than 100 mm. S.L. were taken from between about 101 and 240 fathoms; those from 71.5 to 100 mm. S.L. were taken from between 80 and 112 fathoms; and a 57.5-mm. S.L. specimen was taken at Dinner Key in Biscayne Bay, Florida. An 87-mm. T.L. specimen was reported from between 21 and 31 fathoms (Hildebrand, 1954, p. 318), and the 2⅓ inch holotype was taken "on the reef at Garden Key" (Jordan and Thompson, 1905, p. 254).

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